

WISCONSIN ENDANGERED RESOURCES REPORT 39

WISCONSIN GREAT EGRET RECOVERY PLAN

By Kathleen J. Fruth

SUMMARY

The great egret (Casmerodius albus) is a threatened species in Wisconsin. This document provides information on life history, status and distribution and limiting factors, and proposes investigative and administrative activities necessary for recovering the great egret in Wisconsin. A recovery goal will be determined following an evaluation of potential nesting and feeding habitat in Wisconsin.

Great egrets were hunted on a massive scale on their nesting grounds throughout their breeding range in the late 1800s and early 1900s, particularly in the southern U.S. where large concentration of the birds could be found. Great egrets, along with numerous other large colonial wading bird species, were hunted almost to extinction for their plumes which were in great demand by the millinery trade. Protection did come through the establishment of sanctuaries and the enactment of legislation that outlawed the hunting practices that nearly caused the extinction of numerous species.

Following protection, great egret numbers recovered rapidly from the devastating effects of hunting. More recently though, habitat loss and degradation has been linked to loss of colonies and to limited expansion of populations. In Wisconsin much research regarding this species is still needed. This plan recommends research that includes activities intended to provide potential management solutions, it includes recommendations to establish a long-term monitoring program, and to develop a policy for addressing great egret nesting rookeries on private lands. Information and education of the public is an essential factor in the recovery of this species.

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THE WISCONSIN GREAT EGRET RECOVERY PLAN

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June 1988



DATE: June 29, 1988

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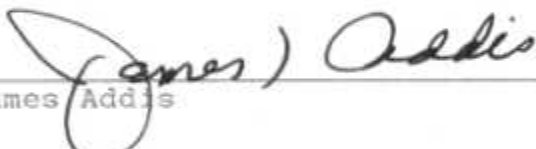
Please review and approve the attached recovery plan. The Executive Summary delineates the objectives of the plan.

This plan has been reviewed by experts from the Wisconsin Department of Natural Resources, Minnesota DNR, United States Fish and Wildlife Service, the University of Wisconsin, and the private sector.

This plan is a dynamic document that will be revised as necessary to incorporate new techniques and modified objectives.

Copies of the plan will be available upon request.

APPROVED:


James Addis

7/5/88
Date

WISCONSIN GREAT EGRET
RECOVERY PLAN

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Executive Summary

The great egret is a threatened species in Wisconsin. Only 7 egret colonies were known to be active in Wisconsin in 1978; 5 of which were located along the Mississippi River. Historical problems such as over-hunting and the subsequent problems of habitat loss and degradation, are factors that have affected great egrets populations in Wisconsin as they have great egrets and other colonial wading birds throughout temperate and tropical America.

Due to the lack of research and management information necessary on which to base recovery regarding requirements for great egret recovery in Wisconsin, no numerical goal will be set at this time. The long-range goal is to maintain a viable population of great egrets in colonies distributed throughout the state. The short-term goal will be to obtain the research and habitat inventory results needed to determine the minimum viable great egret population level for Wisconsin.

This plan contains three main sections. Part I provides background information on status and distribution, biology, life history and other information pertinent to the understanding of this species. Part II describes the location and histories of great egret colonies in Wisconsin. Part III describes the activities recommended for achieving the objectives of this recovery plan.

Activities recommended for achieving the objectives of this plan include:

1. Conduct research and investigations including nesting and feeding habitat inventories, population surveys, a management technique study at a selected site and other biological monitoring.
2. Develop a long-term monitoring and management program for the state, and in particular for the Upper Mississippi River Region. This program will involve Wis., Minn., Ill., Iowa, the U.S. Fish and Wildlife Service and the Corps of Engineers.
3. Recommendations for developing a policy for great egret rookeries on private lands. Specific guidelines are suggested, but complete policy development will entail input from various WDNR bureaus and the public. A spirit of positive cooperation and involvement by landowners is a primary goal.

4. Implement information and education programs to increase awareness and understanding of great egrets as well as other large colonial waterbirds in Wisconsin. Specific informational and educational efforts should be directed at landowners with great egret nesting or feeding habitat.

This plan has been reviewed by the Wisconsin Department of Natural Resources bureaus of Endangered Resources, Wildlife Management and Research, and the Resource Management Administrator, the U.S. Fish and Wildlife Service and outside experts.

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I. BACKGROUND

A. Introduction

The great egret (Casmerodius albus) was placed on Wisconsin's endangered and threatened species list in 1979. In the late 1800s to early 1900s this species was hunted almost to extinction throughout its breeding range due to the fashion industry's demand for the elegant plumes. Populations recovered from the lows of that era, but since then wetland alteration and drainage have reduced and/or degraded the habitat available to this species. Pesticides and other chemical contaminants may pose additional problems.

Surveys along the Upper Mississippi River (UMR) in the past 10 years have indicated the most drastic population declines to be occurring in the southern part of the UMR where development and water quality are believed to be the main factors influencing the decline (Thompson 1978); declines have also been noted in the Wisconsin UMR colonies (Mossman and Thompson 1985).

This document provides natural history information on the great egret and recommends research and management actions to guide efforts to remove the great egret from the Wisconsin threatened species list. The long-range goal is to maintain a viable population of great egrets in colonies distributed throughout the state. This plan will not prescribe a numerical goal based on this species' past population levels in Wisconsin. A comprehensive statewide inventory and an evaluation of potential suitable habitat for this species have not been conducted and this should be considered a priority objective to be completed by December 1989. It may then be possible to determine a statewide recovery level.

The identification, protection, and management of nesting and feeding habitat for great egrets will also benefit other colonial waterbirds as well as other species using the wetland ecosystem. Great blue heron (Ardea herodias), black-crowned night heron (Nycticorax nycticorax), and double-crested cormorant (Phalacrocorax auritus) are often found nesting and feeding in association with great egrets in Wisconsin.

Although this recovery plan addresses Wisconsin recovery efforts, recommendations are made for regional cooperation between the United States Fish and Wildlife Service (USFWS) and the Corps of Engineers, as well as with the states which contain active great egret colonies along the UMR within their borders--Wisconsin, Minnesota, Iowa and Illinois (Appendix A). The status of the great egret along the UMR should be pursued as a regional effort. An accurate perception of the great egret's population in this important region can only be achieved through coordinated efforts of the agencies concerned. It is necessary, for example, to know

if increases or declines in numbers represent actual changes in reproduction or shifts in use of available areas in the states along the UMR.

B. Description

The great egret is a member of the Family Ardeidae, in the Order Ciconiiformes. Former names include American egret and common egret.

Great egrets are large, predatory wading birds that average 37-41 inches in length, weigh about 32-40 ounces and have about a 55 inch wingspan (Palmer 1962). Plumage is all white; the lores (area in front of the eyes) are featherless and yellow in color, as is the bill. The iris is also yellow. The feet and long legs are black. The long neck is pulled back into an S-curve, and the legs are extended back when the bird is in flight. The sexes are similar in appearance, but males tend to be slightly larger than females (Palmer 1962). Vocalization includes the loud, low croaking "cuk-cuk-cuk," (Bent 1926) commonly heard when a bird is disturbed and takes to flight; "frawnk," "kroogh," and "arre-arre" calls are described by Weise (1976).

Two other white egrets, the snowy (Leucophoyx thula) and the cattle egret (Bubulcus ibis) have been recorded in Wisconsin, but with lesser frequency. Both are smaller and possess field marks (snowy has black legs, yellow feet, and the cattle egret has yellowish to pinkish legs) that distinguish them from the great egret.

C. Distribution and Status

1. General

The great egret was one of the many victims of the plume hunting era of the late 19th and early 20th century. They were killed on a massive scale for their beautifully elegant plumes, or aigrettes, which were mainly used in the millinery trade for adorning women's hats (Bent 1926, Palmer 1962, Erwin 1985).

The former breeding range of the great egret extended throughout tropical and temperate America from Oregon, Nevada, Utah, Illinois, Wisconsin, Indiana, and southern New Jersey south to Patagonia (Howell 1932). The largest great egret colonies were in Florida, the Gulf states and states of the Mississippi River Valley (Cook 1913), but as a result of plume hunting, populations of many wading birds were extirpated locally or at their lowest point by 1902-1903 (Palmer 1962).

Conservationists worked to protect declining species by establishing sanctuaries and legislation such as the Migratory Bird Protection Act (Erwin 1985). Many species, including great egrets, responded rapidly and recovering populations peaked in the 1930s (Palmer 1962, Ogden 1978).

By the mid-20th century great egrets bred locally from southeastern Oregon, southern Idaho, northern Texas, central Oklahoma, southern Minnesota, western Wisconsin, central Illinois, southern Indiana, northern Ohio and southwestern New Jersey south through Mexico, Central America, the West Indies, and South America to the Strait of Magellan (AOU 1957). Ogden (1978) describes a post-plume-hunting extension of this species' range along the Atlantic Coast into states north of New Jersey.

Wintering grounds include South America, Central America, some Caribbean islands and southern and western U.S., namely California, Oregon, Texas, Louisiana, Florida and South Carolina. Figure 1 shows the general breeding and wintering ranges of the great egret in North America.

2. Wisconsin

Prior to the widespread hunting of egrets, Wisconsin was included in the great egret's breeding range (Cook 1913, Bent 1926). They were described by Kumlien and Hollister (1903) as a "common bird on the larger marshes and swamps bordering the inland lakes and rivers" during the mid-1800s. King (1949) suggested that Kumlien and Hollister's description referred mainly to southern and eastern parts of the state. Breeding during the plume hunting era was last recorded near Waukesha in 1886 (Kumlien and Hollister 1903). Great egrets were not found breeding in Wisconsin for more than 50 years until 1939, when 3 nests were found in the Trempeleau Bottoms along the Mississippi River (Gabrielson 1939).

In the same way that numbers of nesting egrets declined, reports of large numbers of summer post-breeding wanderers known to utilize Wisconsin marshes (see Migration) diminished to "none" or "few" birds where there used to be hundreds (Kumlien and Hollister 1903, King 1949).

The paucity of references to specific Wisconsin breeding sites prior to the plume hunting era and subsequent recolonization in 1939, makes it difficult to assess the number of breeders and post-breeding visitors. However, based on the extent of available habitat previously, particularly along the Mississippi River, it is likely that nesting was more common than is reflected in the early records.

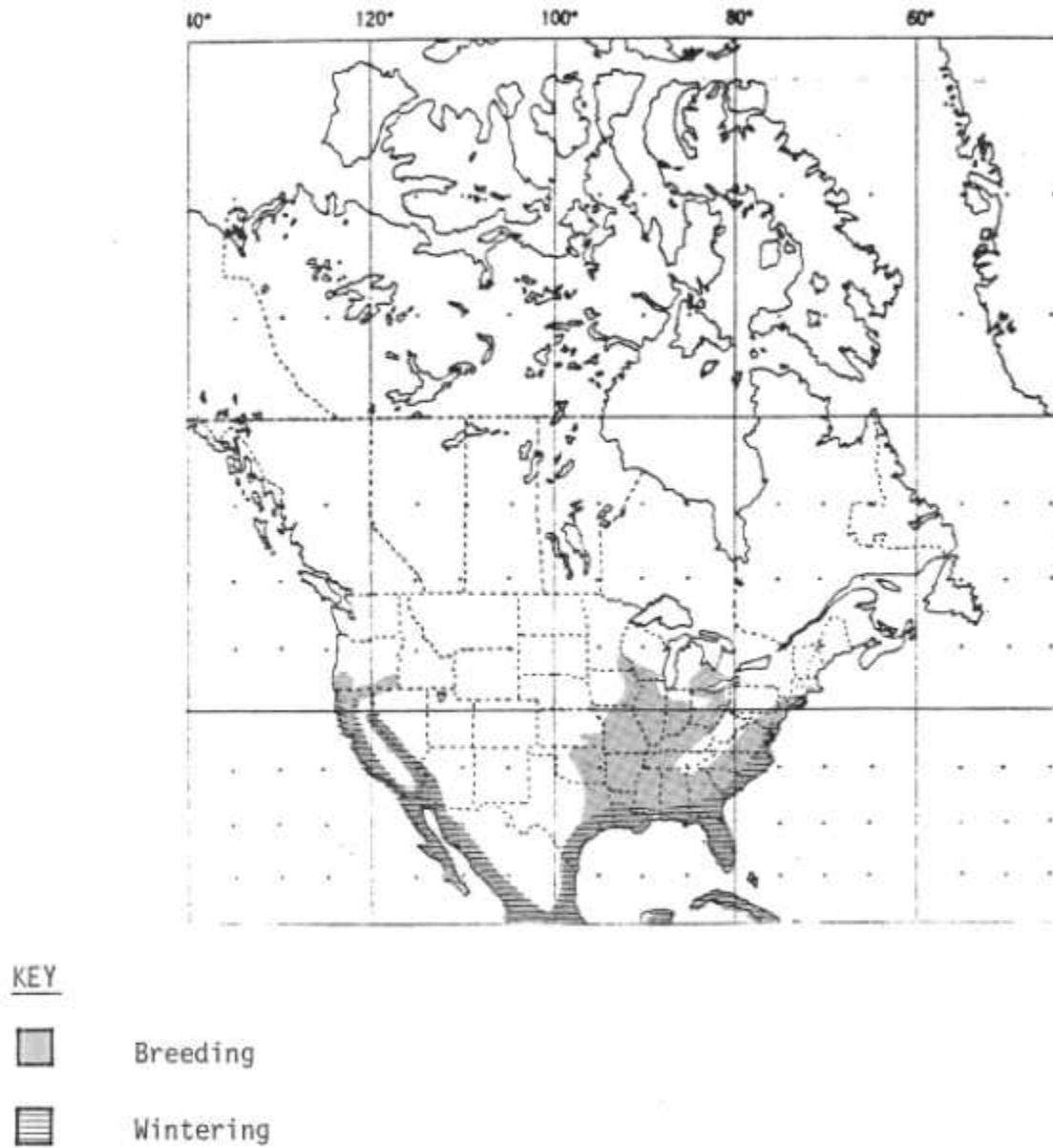


Figure 1. General breeding and wintering distribution of great egrets in North America.

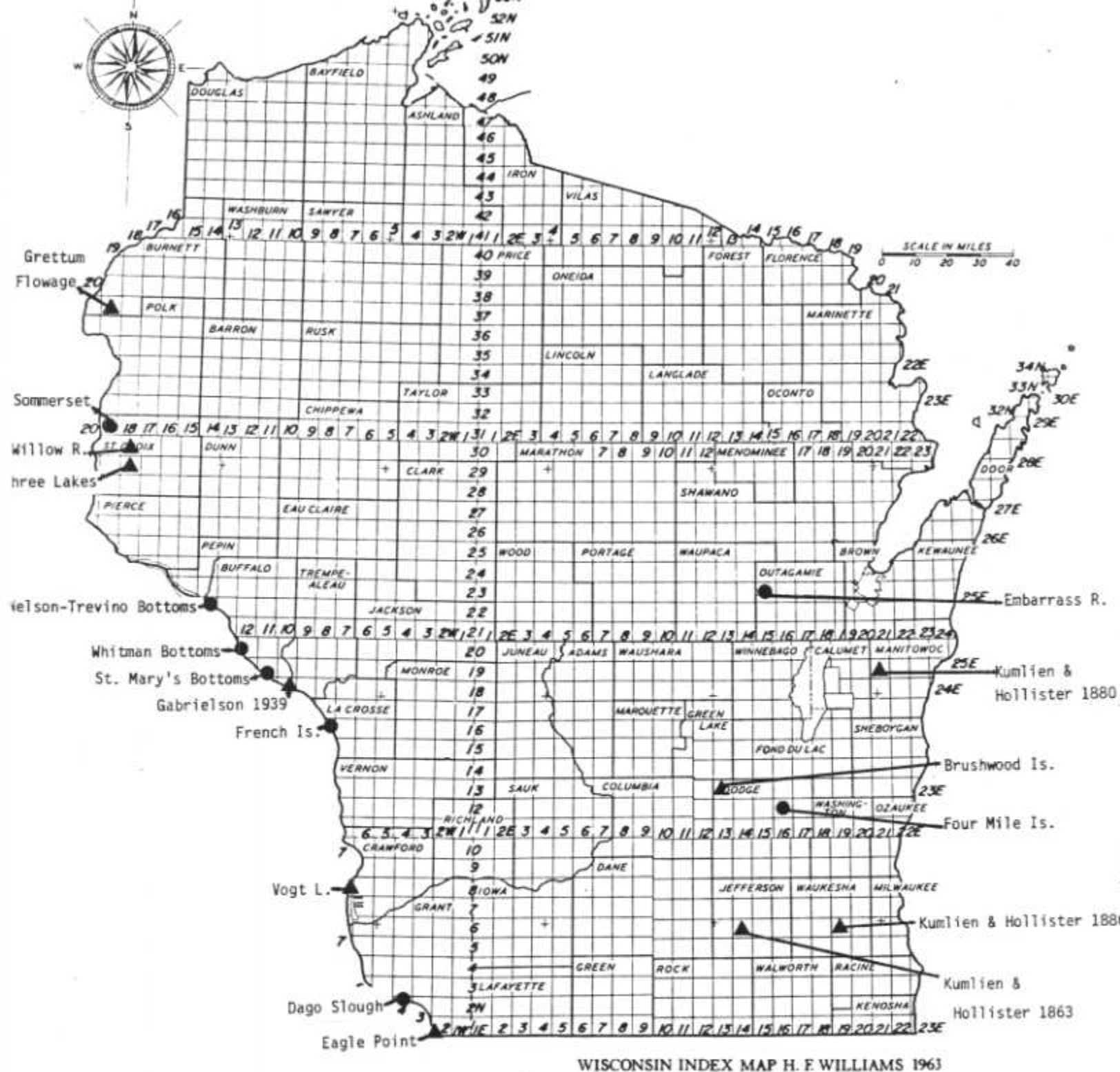


Figure 2. Great egret nesting sites in Wisconsin. Site names correspond with those listed in Part II of document.

KEY

- Site active in 1987
- ▲ Recent or historical site not active in 1987

In 1987, there were 7 great egret colonies known to be active and 1 suspected but unverified. Current and historic locations of known great egret colony sites are shown in Figure 2 (see Part II for background information concerning great egret colony sites in Wisconsin). All of the great egrets in Wisconsin nest in association with great blue herons. At Four-mile Island 2 additional colonial species, black-crowned night herons and cormorants, also nest. The majority of Wisconsin's great egret colonies are located along the UMR. Results of a multi-state aerial survey conducted along the UMR in 1984 showed a 10% decline in the number of active great egret nests between Dubuque, Iowa and Maiden Rock, Wisconsin (approximately 200 miles) since 1977. Results of that same study showed that the number of active nests in Wisconsin alone were down 24% compared to the 1977 survey results (Mossman and Thompson 1985).

D. Migration

The great egret exhibits an extensive post-breeding, northerly dispersal that precedes the fall migration. The precise reason for such movements, mainly by juveniles in July and August, is not known, but it results in egrets wandering as far north as Canada.

Nine different ecological regions were described by Palmer (1962) as being relevant to the great egret populations in the U.S. Byrd (1978) found migration patterns to be consistent with the regions described by Palmer.

Except for some juveniles, great egrets of the Atlantic Coast, including the Florida breeders, generally migrate to Florida and further south to Cuba, the Bahamas, and other Caribbean islands. Juveniles will winter along the coast as far north as New York.

The major migration route and wintering sites for birds in the southern and gulf states (except Florida) are west along the gulf coast (Louisiana, Alabama, Texas) and into Mexico and further south. Some also move to western Jamaica and western Cuba, but do so by moving into the Yucatan Peninsula and crossing the Gulf of Mexico from there.

Most birds of the UMR drainage (including Minnesota) follow the drainage south and then west along the gulf coast route. Ohio's great egrets follow the Mississippi River drainage south but then move east and follow the same patterns as the Atlantic coast migrators. No specific band returns were mentioned for Wisconsin, but Wisconsin egrets probably follow the same route as Minnesota birds, rather than the Ohio birds.

The birds of the west coast population (Oregon and California) move south to Texas, Baja California, and on into Mexico and Central America.

E. Life History

1. Food and Feeding Habits

Great egrets feed mainly on fish, but also eat frogs, salamanders, lizards, small snakes, snails, crustaceans, grasshoppers and other insects; and where they feed terrestrially, will also take mice and moles (Bent 1926, Palmer 1962). They forage along pond and stream edges, in swamp openings and other areas where there is open water, such as lagoons and floodplains of major rivers (Graber et al. 1978).

Thompson (1978) conducted a study of nesting great blue heron and great egret feeding areas within the UMR floodplain, and he found great egrets to be more specific in their feeding site choices than great blue herons. Great egrets fed mainly in large, open, treeless marshes with emergent and submergent vegetation, whereas great blue herons were observed feeding in a wider variety of aquatic areas including wooded sloughs and wooded margins of open marsh. Although great egrets are confined to fewer types of foraging areas, they show greater flexibility than great blue herons in rapidly locating and exploiting new feeding areas on a daily basis (Thompson 1978).

Great egrets hunt at dawn and dusk, roosting during the day and at night after sunset. When young are present in the nest and the food demand increases, the adults will hunt throughout the day. Distances of foraging sites from colony sites has been documented. Graber (1978) noted adults fishing at lagoons 9.6 km from a colony in Illinois, while birds believed to be nesting at Horicon Marsh were observed more than 16 km away from the colony (J. Bielefeldt in lit., WDNR). Thompson and Landin (1978) found great egrets nesting along the UMR traveled about 20 km to feed. The maximum distance traveled was by an egret that flew about 35 km up a tributary to an improved trout stream (Thompson 1978).

Typical of large wading birds, great egrets slowly walk or wade through the water searching for underwater prey. The stout bill is typically used to grab prey from below the surface rather than stab it (Kushlan 1978). They will sometimes stand in one spot if prey is carried towards them by water movement (Schlorff 1978). Egrets locate their prey using binocular/monocular vision (Kennedy in Hoffman 1978).

Small prey are swallowed immediately, while larger items must be controlled and worked into position before swallowing whole. Kushlan (1978) describes 17 different feeding behaviors for the great egret.

The concept of social food signaling, whereby birds locate good feeding sites by seeing or following successful feeders, is

thought to play an important role for egrets and other waders in locating food resources (Armstrong in Kushlan 1976).

Great egrets are considered aggregate feeders; they will feed in association with conspecifics and with other wading birds. Inter- and intra-specific defense of feeding zones is maintained in feeding aggregations, with the larger of the competitors usually winning (Kushlan 1976, 1978). Great egrets also feed alone--individuals can commonly be observed feeding alone at sites in Wisconsin.

Because of the differences in sizes of wading birds, there is some natural division of food resources. The egret's long legs allow it to feed in deeper water than some smaller herons such as the black-crowned night heron or yellow-crowned night heron (Custer and Osborn 1978). While studying the dietary habits of herons in southwestern Lake Erie, Hoffman (1978) found that great egrets fed their young smaller fish than did great blue herons or black-crowned night herons. These differences in prey selection may contribute to an understanding of resource partitioning among herons and egrets.

The feeding habits of great egrets in Wisconsin are not well known, but reports of observations at Four Mile Island (Horicon Marsh) by Johnson (unpublished WDNR report 1977) indicate that great egrets fed on smaller fish than did the great blue herons.

Great egrets nesting along the UMR usually stay within the UMR floodplain, feeding in the backwaters or near the mouths of tributaries, and sometimes they were observed far up the tributaries (Thompson 1978). During a study of foraging sites along the UMR, (Thompson 1978) observed no use of the heavily cultivated uplands by either great egrets or great blue herons. Four Mile island residents forage in open water areas throughout Horicon Marsh and beyond.

2. Reproduction

Great egrets are colonial nesters. One pair to several thousand may nest together, especially where there is extensive habitat such as in Florida. They often nest in association with other colonial birds in the Ciconiiformes and Peliciformes orders. In Wisconsin, all great egrets nest in association with great blue herons and in some places with other species.

The nest is constructed of sticks, loosely assembled into a flat, platform structure. Nests generally are situated in the upper branches of medium-sized trees, 20-40 feet up (Howell 1932). Trees of the floodplain forest, swamps, or islands in marshes and rivers are common nesting locations, but nesting habitat varies depending on the area and local conditions.

Onset and length of the breeding season vary according to geographic location. The laying season can begin in January in Florida and last until July (Howell 1932), while laying in Michigan begins in early April and extends into July (Stewart and Robbins in Palmer 1962).

The long white plumes, which develop before the birds arrive at the nesting grounds, comprise the breeding plumage of both males and females. The plumes emerge from the dorsal region and drape like a cape down the back and over the tail, nearly touching the ground. These are the feathers the plume hunters of early days collected and sold. Bent (1926) counted as many as 54 plumes were counted on one bird, but most birds possess fewer than that. The plumes are shed by June or July during the post-nuptial molt.

a. Nesting

Breeding activities begin about 2 weeks after the birds arrive at nest sites. A decrease in time males spend away from roost sites and an increase in their aggressive displays signals the onset of pair formation and nesting; males defend potential nest sites by chasing intruders out of their area (Weise 1976).

Males that have claimed preferred sites where old nests remain begin rejuvenating them by adding new material. Those that do not secure "preferred" sites must construct a nest from scratch, collecting dead sticks and taking sticks from nearby completed nests (Johnson unpublished); material may also be broken from live trees. Old, pre-existing nests may be preferred because they require less nest preparation time and allow more time for behavior displaying.

Knowles (1984) studied the great egret's nest selection pattern in a Wisconsin colony and found that the rookery's colonization pattern proceeded from the center to the perimeter. Great blue herons that had arrived at this same colony 2 weeks earlier had nested according to this same pattern. Knowles suggested that center sites may be preferred because they are potentially less vulnerable to predation or other disturbances. Since Knowles only evaluated the presence of pairs in trees and did not evaluate the reuse rate of old nests versus newly built nests, it is difficult to compare these findings with Weise's (1976).

When females are present in the colony males attempt to attract them to their territory through displays. Males may copulate with any female that lands on the platform, but pair formation eventually develops over 2 days with repeated response of one female to the male's vocal greetings and recognition of that female's response by the male, and through mutual nest building by the pair (Weise 1976). Weise collected extensive data on great egret courtship and pair formation in Louisiana and Florida. Refer to Weise (1976) for more details concerning these

activities.

b. Eggs and Incubation

Eggs are pale blue to pale bluish-green (McVaugh 1972), oval to oval-elliptical in shape and average 56.5 X 40.5 millimeters (Bent 1926). Average clutch size has been noted to increase from 3, to 3-4 with increasing latitude north from the gulf states (Palmer 1962). Both male and female incubate the eggs for a period of 23-24 days (Bent 1926).

Incubation commences before all eggs of the clutch are laid, resulting in asynchronous hatching and a 1-3 day age difference among the young (Mock 1985). Mock suggested that this age difference, and subsequent size difference, is a significant factor in sibling competition for food.

c. Young

Hatchlings possess long, hair-like down on the forehead, crown, and sides of the head. Shorter down appears on the back and the underparts are sparsely covered. Skin is grayish to pinkish (varied among observed individuals) for the first few days changing to pale gray-green. Refer to McVaugh (1972) for more detail regarding physical growth and behavioral development of great egret chicks.

Both parents feed the young by regurgitating food onto the nest floor. This regurgitation is stimulated by the young grasping and shaking the adults' bill (Bent 1926, Mock 1985). The regurgitate emerges as a bundle, or bolus, of small fish or other items and saliva. In early stages the young pick the food off the floor, but as they grow the larger, quicker more aggressive individuals learn to catch the entire bolus just as it leaves the parent's mouth (Mock 1985).

Mock (1985) studied the competitive behavior of great egret and great blue heron chicks in a Texas heronry. He observed that great egret chicks were substantially more aggressive to siblings than were great blue heron young. As mentioned earlier, great egrets tend to feed their young smaller fish than do great blue herons. In the case of great egrets, an individual can monopolize the feeding by swallowing the entire bolus. When large fish are regurgitated, as with great blue herons, all young have a better chance at getting some portion of the food because it is too large for one to swallow whole.

Pratt (1970) recorded great egret nestling mortality (19% in 1967, and 43% in 1968) in a California egret/heron rookery and noted that 2 to 3-week old nestlings were the most frequent age class found dead. The reason for the increased mortality in 1968 was not known, but Pratt stated, "Competition for food is

probably a major factor in nestling loss and its effect is probably greatest at this age."

Mock (1985) observed that sibling aggression occurred more frequently in great egrets than great blue herons, even when food was abundant. Great egret siblicide was commonly observed in the study and included preventing sibs from eating, and physically attacking and driving sibs from the nest, thereby causing them to fall or be attacked by neighbors. Mock attributed the lower success rate he found in great egrets to aggressive sibling behavior. Johnson (1977) observed aggression in great blue heron chicks on Four Mile Island, but did not mention great egret aggression.

d. Fledging

Nestling plumage is all white and juvenile plumage is similar to the adults (Bent 1926). Prior to fledging, the young venture out of the nest and crawl about on nearby branches. When disturbed, they will leave the nest. This often leads to attacks from young in neighboring nests.

Young great egrets take their first flight about 6 weeks after hatching (Palmer 1962). At this time they are about one-half adult size (Bent 1926). Juveniles may hunt and feed near the colony.

3. Wisconsin Nesting

Observations by Johnson (1977) for 1971-1972, showed that great egrets arrived in Wisconsin at Four Mile Island (Dodge Co.) around April 1, moved into the rookery a week later and began nest building behavior by April 10. He described great egret nests as being "less substantial" than great blue heron nests, which measured about 0.8 meters in diameter, "but large enough to adequately accommodate three to four young." The first great egret young were observed (1-2 days after hatching) on June 3.

Average clutch size for Wisconsin nests is 3-5 eggs. The mean number of young per nest was 2.41 (range: 2.1-3.1) for observations made at Four Mile Island between 1971-1987 (Table 1).

Wisconsin experiences an influx of post-breeding juvenile wanderers in July and August. Band return information for Wisconsin egrets is lacking so precise information regarding post-breeding dispersal and migration is not known. Migration to wintering grounds begins in September; most birds are probably gone by October; in some birds may remain into November (Graber 1978).

F. Limiting Factors

Colonial nesters, such as great egrets, are potentially very vulnerable to large losses at one time. The concentration of a population in one place has the potential to be suddenly and drastically altered by such events as weather, disease, human disturbance, or a localized environmental change, causing a depletion of the food supply or decimation of the nesting habitat.

1. Availability of Suitable Habitat

This is probably the most critical limiting factor for this species and will likely be even more so in the future. Wisconsin lost about 46% of its wetlands between 1850 and 1970 (Thompson and Volkert 1978).

Logging of flood plain forests reduces nest site options, while hydrological alterations, such as wetland drainage and river channelization (causing loss of shallow backwaters) reduces feeding site options. In addition, degradation of riverine and palustrine habitat by pollutants and contaminants, reduces or eliminates food resources.

Many important Wisconsin wetland wildlife areas, created or purchased primarily for waterfowl, have benefited other wetland species including the great egret (Bartelt in lit. 1988). More wetlands need to be purchased, and some existing waterfowl areas may need special management to benefit the great egret.

2. Natural Disasters

Tornados, heavy storms, or strong winds can cause destruction of eggs, death of young and loss of nesting trees if they are wind thrown. In 1984, a July windstorm caused a 25% reduction in reproduction for that year through nestling losses (some adults were also killed). Many nest trees were also toppled in this storm.

3. Finite Longevity of Rookeries

In high density nesting situations where guano accumulates, residents may destroy the vegetation they are nesting in. Weise (1978) found 60% defoliation (8% death of shrubs) in a 7,500 pair mixed heronry in Delaware during the first year of occupation, and in the second year a 100 % death of shrubs that the birds nested in.

Vegetation death is caused not only by defoliating effects of guano on leaves, but also by changes in soil pH. A decrease in the ability of the plants to absorb nitrate, chloride, and phosphate occurs, thereby inhibiting regeneration of vegetation

(Salisbury and Ross in Weise 1978). High salt concentrations in guano changes the water potential at the roots; this interferes with the roots' ability to absorb water and causes damage directly to the root system (Weise 1978). Soil chemistry problems are suspected on Four Mile Island where tree loss and lack of regeneration threatens the nesting status of the colonial species using the site (Appendix B)

4. Toxics and Contaminants

Nosek (1982) tested for the presence of chemical contaminants in herons and egrets in the Whitman Bottoms rookery along the UMR in Wisconsin in 1977 and 1978. He found PCBs in all great egret and great blue heron eggs tested and considered the levels present to be "relatively high" compared to findings in some other states. DDT, DDD and DDE were found in 2, 6 and 7 respectively, of the seven eggs tested for these compounds. Heptachlor epoxide (residual of heptachlore) and dieldrin was found in all heron and egret eggs analyzed. Several other contaminants were also present. Clutch size averaged 3.25 and 3.44 in 1977 and 1978 respectively. Hatch success was 91% in 1977 and 87% in 1978. Fledging success was 2.49 and 2.42 young/nest for 1977 and 1978 respectively, "comparable with levels found in other studies" (Nosek 1982). Production of young was not apparently affected by the levels of toxicants present in the system.

Five black-crowned night heron nestlings were among biota samples collected from the Horicon Marsh National Wildlife Refuge in Wis., for a study (in progress) of the presence of agricultural contaminants in the marsh. Data analysis for all the biota samples has not been completed, but detectable levels of DDE were found in the nestling sample (Zusi pers comm. 1988).

Thompson (1978) suggested that pollution and toxic contamination caused colony declines along the UMR in Illinois and further south. During his 1977 aerial surveys, apparently suitable nesting habitat was identified but was not being utilized. He stated that pollution and contaminant levels in the UMR are worse in the southern portion of the river, and therefore, this area may be unable to support sufficient food resources for herons and egrets.

5. Human Disturbance

Disturbance at a rookery is most damaging during incubation and when young are in the nest. Disturbed adults will fly away leaving eggs or young exposed to the sun's heat (or rain or cold during inclement weather) and predators. Disturbance increases the chance of young leaving the nest and falling to the ground or entering another nest and being attacked by those occupants. Disturbance intensity and duration can vary from people actually entering the colony (researchers, photographers, vandals) to boat

or vehicular traffic. Habituation and tolerance of certain predictable situations are possible (Buckley and Buckley 1976). A colony may respond to disturbance by shifting away from the source if other suitable habitat is available (Thompson and Landin 1978, Knowles 1984), but abandonment can also occur.

Human activities such as logging of a site can have similar or more damaging effects than natural disasters because logging usually removes all trees, not just dead, weak or small ones that might not normally survive a storm.

6. Predators

Losses due to predators are not well documented. Johnson (1977) reported that great-horned owls nesting on Four Mile Island caused only little disturbance in this rookery. Crows, turkey vultures and raccoons are also potential predators (Bent 1926). Rookery disturbance causing adults to leave eggs and young unprotected creates an opportunity for predators to cause damage.

Observations of some abandoned heron rookeries at Crex Meadows and Fish Lake Wildlife Areas (Burnette County) indicated that abandonment was caused by harassment from bald eagles that established nesting territories where the rookery was located (Evenson pers. comm. 1988).

7. Disease and Parasites

Chlamydiosis, an infectious bacterial disease caused by Chlamydia psittaci, is known to cause problems in great egrets. It can spread rapidly among colonial nesting birds and can be transmitted to humans (J.C. Franson in lit. 1988).

Eustrongylides sp. is a common nematode parasite of fish-eating birds (Franson in lit. 1988). Individual mortality in ardeids has been reported in 5 general locations in the United States including a great blue heron from Oneida County, Wis., and for great egrets, black-crowned night herons and great blue herons in the western basin of Lake Erie (Roffe 1988). One case of Eustrongylides-caused mortality found in more than 400 great egrets was reported for a large egret colony on Avery Island (Louisiana) in 1985. Three other incidences of large scale ardeid mortality due to Eustrongylides sp. infection were reported for a site in Indiana in 1976, and for a site in Delaware in 1976 and 1977 (Roffe op cit.).

Avian botulism Type C, a toxic disease caused by ingesting toxins produced by the bacterium Clostridium botulinum, is generally associated with frequent waterfowl die-offs throughout the United States, but occasional cases are also reported for herons (Friend, et al. 1985).

II. GREAT EGRET COLONY SITES IN WISCONSIN

Descriptive and chronological summaries are provided for each colony site. In some cases, tables in their original form are combined with listed information. Sources of information and tables are provided. The following species abbreviations are used:

great egret=GE	black-crowned night heron=BCNH
great blue heron=GBH	double-crested cormorant=DCC

Recently Active Colonies

Dodge County

Four Mile Island-(T12N R16E S.19 SE) Ownership-WDNR. This site is a 15-acre State Natural Area (designated as a Scientific Area in 1965) situated within the 10,962 acre Horicon Marsh Wildlife Area (southern part of marsh); the northern portion of the marsh (20,797 acres) is the Horicon National Wildlife Refuge, owned by USFWS.

This rookery site is unique and important for several reasons;

1. It is the largest inland heron/egret rookery in Wisconsin.
2. It is the most consistently monitored Wisconsin rookery. The year of colonization by egrets is known, and information regarding species composition, population data, and habitat conditions have been collected since 1971.

1943-first year of nesting for GE, 2 nests (King 1949).

1944-1948-1 GE nest during each year except 1944 (2 nests) (King 1949).

1952-8 to 12 GE pairs nesting among GBH and BCNH; 1,750 nests total. from Wis. Conserv. Dept. records.

1971-1987-see Table 1 next page.

Table 1. Population and production estimates of herons and egrets using Four Mile Island, Horicon Marsh, WI.*

Year ^{a/}	Great blue heron		Great egret		Black-crowned night heron		Total number of nests
	Number of nests	Young /nest	Number of nests	Young /nest	Number of nests	Young /nest	
1971	371	2.8	146	3.1	459	1.4	976
1972	538	3.1	348	2.8	169	1.5	1055
1973	669	1.8	263	2.1	381	2.3	1313
1974	768	2.2	282	2.4	516	2.2	1566
1975	639	2.2	234	2.3	356	2.3	1229
1976	872	2.5	242	2.1	500	2.4	1614
1980	534	1.9	208	2.0	1147	--	1889
1981	504(476-532) ^{b/}		311(285-337)		1246	2.7(2.4-3.0)	2061
1982	721	2.1(1.9-2.3)	309	2.4(2.0-2.8)	854	1.7(1.4-1.9)	1884
1983	474	2.3	193	2.9	367	--	1034
1984	396-503 ^{c/}		139-179 ^{c/}		154	--	689-836
1985	705	1.8	302	2.0	154	--	1161
1986	437	2.2	281	2.1	281	--	1021
1987	712	2.4	268	2.7	52	2.5	1380

^{a/} From 1971-76 data was collected by Dick Johnson on the Rock River surveys. In 1980 a complete count was attempted in June and July. In 1981-87 transects were used to estimate both the species composition of nests within the rookery and the number of young per nest in June. A complete count of all nests is conducted in January to obtain a total population estimate. January nest counts are adjusted by June species composition.

^{b/} Numbers in parentheses are confidence intervals.

^{c/} The lower number is the number counted in January. The higher number is the estimated population from June counts.

^{d/} Actual production was lower (10-22% for GBH; 25-26% for GE) because of a severe storm in July 1984 that caused destruction of trees, nests and young.

*From Bartelt in litt., WDNR files.

Brushwood Island (Fox Lake) (T13N R13E S.23 NE) Ownership-private property. Size of colony is approximately 2.75 acres (600 ft. X 200 ft.)

1960-1969 -See Table 2 next page.

Table 2. (from Emlen in lit. WDNR files).

Estimates of Active Heron Nests on Brushwood (Ashley) Island, Fox Lake, Wis.

(Data collected by U.W. Ornithology Class on field trips)
1960 - 1969 Compiled by J.T. Emlen*

<u>Year</u>	<u>Date(s)</u>	<u>GBH</u>	<u>Common Egret</u>	<u>BCNH</u>	<u>Total Nests</u>
1960	May 7	155	25	80	260
1961	April 22	166	28	30	224
1962	May 6	142	39	70	251
1963	April 27	151	21	26	198
1964	April 25	167	12	24	203
1965	May 1	188(50)	35(27)	27(27)	223
1966	April 24	127	36	15	171
1967			-	-	-
1968			-	-	-
1969	May 24	147	0	0	147

* Values are best estimates of number of pairs present based on nests with birds on or close by.

1971-15 GE nests, 133 GBH nests.

1972-17 GE nests, 157 GBH nests.

1973-13 GE nests, 169 GBH nests.

Productivity averaged 1.8 young per nest 1971-1973 (lower than that at Four Mile Island during that same period). (Records for 1971-1973 are from Johnson 1977). GE abandoned this site after 1973; nesting was not confirmed again until 1983.

1983-estimate of 12 GE nests (WDNR files).

1984-19 GE nests, 104 GBH nests" "

1985-1987-no GE nesting (Nigus in lit. 1988).

Outagamie County

Embarrass River Bottoms-(T23N R15E Sect.27 SW)

Lowland hardwood stand, east side of the Embarrass River.

Ownership-private.

1978- First year rookery was reported (great blue herons only).
 James Anderson and Ray Anderson counted 60-75 great blue heron

nests.

1980- David Dunsmoor marked 125 nest trees, collected nest tree data and counted nests according to size (small, medium, large and fragmented); nest total was 295. Dunsmoor did not mention great egrets present, only great blues. He noted an increased number of great blue herons here compared to past years when the colony was stable at around 80 nests. He correlated the increase here with a decline in a colony 10 miles south following logging of that site.

1984- First year that great egrets are reported for this site. In an aerial survey on 10 May, Mossman and Dunsmoor counted 21 great egret nests and "many" great blue heron nests. A limited ground count was conducted on 27 May--5 great egret and 95 great blue heron nests were counted in the sample area.

1987- The rookery was estimated to contain a total (includes GBH and GE) of about 1,000 nests in 1987 (Dunsmoor pers. comm., Feb. 1988), but the number of great egret nests was not known. Dunsmoor concurred with J. Anderson's estimate of rookery size of about 200 yards X 100 yards.

Except where otherwise specified, all the information for the years listed above is from WNDR files.

Potential threats: There is no immediate threat to this site. Contact has been made with the landowner and a verbal agreement made that he would contact the DNR if he considers changing the disposition of his land; permission was given to enter the property to conduct surveys.

Currently, adjacent property (upon which a small proportion of the rookery extends) owned by a different person is contracted to be logged in the next 2 years. This action should not greatly impact the colony immediately if, in fact, only a small portion of the colony extends into it. A buffer zone of trees may be needed to screen the colony from wind and other disturbances. In addition, the opportunity for colony future expansion colony may be reduced, particularly if other area landowners also begin logging.

St. Croix County

First known breeding of great egrets in St. Croix Co. was in 1976. All 1976 information is from Craig Faanes (WDNR files in litt.)

Ten Mile Creek-(T30N R18W S.17)

1976-2 GE nests, 18 GBH nests.

Three Lakes-(T29N R18W S.5)

1976-3 GE nests, 17 GBH nests.

Somerset(Rice L. Flats, Apple R.) (T31M R19W S.20 NW)
Ownership-WDNR. This site is located east of the St. Croix River just north of the confluence of the St. Croix and Apple Rivers. The rookery is located within the St. Croix Island State Wildlife Area.

1986-at least 1, maybe 3 GE nests among 37-39 GBH nests. Most nests in green ash, a few in silver maples. (Mossman in litt, WDNR files). This is the first verification of nesting by GE at this site.

1987-Victoria Grant (St. Croix National Scenic Riverway) counted a total of 36 nests during a July 28th aerial survey; no birds were present and she was unable to determine if GE had nested at all.

Burnett CountyGrettum Flowage(Fish Lake Wildlife Area) (T37N R19W S. 10,11)

1974-egrets were observed on the newly-flooded flowage, but no nesting was reported (Evrard 1975).

1975-3 GE nests found in water-killed jack pine, 5 GBH nests and and 12 DCC nests (Evrard 1975).

GE nested at this site for 1 or 2 years following 1975, and then abandoned when an eagle pair established the site as a nesting territory (Evrard pers comm 1988).

Crex Meadows Wildlife Area (T39N R18W S. 31, 28)

No nesting has been recorded for this site but GE have been recorded as present since 1953 (in lit. WDNR files). It is suspected that GE using the area are coming from rookeries nearby in Minnesota (Mossman in lit. 1984)

(Upper Mississippi River Colony Sites)

Unless otherwise cited, all UMR data for year 1984 and 1987 is from Mossman and Thompson unpublished WDNR report, and USFWS McGregor District unpublished report, respectively.

Buffalo County

Nelson-Trevino Bottoms (Hershey Slough) (RM 761.9, Pool 4) (T22N R14W S.2 NW SE, south edge). One mile north of Hwy 25, access by boat only. Ownership-USFWS. 185 nest trees have been tagged at this site.

1968-50+ GE nests, 300+ GBH nests. (Thompson &
 1972-Total of 389 GBH and GE nests. Landin 1978)
 1976-Total of 407 GBH and GE nests.
 1977-30 GE nests, 255 GBH nests; 111 trees (silver maple,
 cottonwood, american elm and green ash) (Nicklaus 1977).
 1984-43 GE nests out of total 400-500 nest present.
 1986-711 total nests, number of GE nests unknown. (Linderud pers.
 comm. 1987).

Whitman Bottoms State Natural Area (Kieselhorse Bay, Idlewild)
 (RM 737.6, Pool 5A), (T20N R12W S.34 NW SE). 0.5 mile east of
 north end of Lock and Dam No. 5. Ownership-WDNR; it is an
 approximately 154 acre scientific area located within the 1,500
 acre Whitman Dam Wildlife Area.

1968-+20 GE nests, + 100 GBH nests. (Thompson &
 1972-551 GBH and GE nests. Landin 1978)
 1975-587 GBH and GE nests.
 1976-520 nests (67% GBH, 33% GE) in 231 marked nest trees
 1977-146 GE nests, 294 GBH nests (Nicklaus 1977)
 1978-463 total nests, number of GE nests unknown. (Linderud in
 lit. 1987)
 1980-279 total nests, number of GE nests unknown (Linderud op
 cit.)
 1984-WDNR & MDNR survey estimates 70 GE nests, 165-200 GBH nests.
 1985-525 total nests, number of GE nests unknown. (Linderud op
 cit)
 1986-active but number unknown (Linderud op cit)
 1987-active but number unknown (Linderud op cit)

St. Mary's Bottoms - (Latch Island) (RM 726.6, Pool 6) (T19N R11W
 S. NE SE SW). 0.6 mile NW of Hwy 54 causeway. Ownership-St.
 Mary's College, Winona, Minn..

1977(newly established)-1GE, 12GBH.
 1980-147 GE nests, 140 GBH nests (Knowles 1984).
 1981-155 GE nests, 122 GBH nests (Kowles op cit).
 1982-99 GE nests, 222 GBH nests (Knowles op cit).
 1984-20 GE nests were estimated and 150-200 GBH
 1986-511 total nests, number of GE nests unknown (Linderud op
 cit.).

Grant County

Eagle Point (RM 582.7, Pool 12) (T1N R2W S.29N). 0.35 miles
 south of Hwy 151/61 bridge. Ownership-USFWS

1984-4 GE nests, 11 GBH nests. This is probably the first year
 of occupation by GE. No information is available regarding
 occupation by GE's since then.

Dago Slough (RM 600.9, Pool 11) (T2N R4W S. 6NW NW). Between McCartney Lake and the main channel. Ownership-USFWS.

1957-75 GE nests, 75 GBH nests (Thompson & Landin 1978).
 1977-2+ GE nests, 176 GBH nests (Thompson op cit.).
 1984-no GE nests, 130 GBH nests (Thompson op cit.).
 1987-2 GE nests, 231 GBH nests. (USFWS McGregor Dist. report)

Crawford County

King (1949) has Crawford marked as a county of heavy egret abundance 1938-48, but this refers to users such as post-breeding wanderers, not breeders.

Vogt Lake- (Ambrough Slough, Paint Creek) (RM 640.6, Pool 10) (T8N R7W S.35, center of N-1/2). On long strip of land, between Ambrough Slough and main channel. Ownership-USFWS.

1977-3 GE pairs (Thompson & Landin 1978).
 1984-no GE nests.
 1986-GE nested, number unknown.
 1987-no GE nested (Fruth et.al. 1987).

LaCrosse County

French Island (T16N R8W S.24) (RM 700.3 approx.). South of Smith Slough, between Joe Lynn Slough and the river bank. Ownership-USFWS

1987-approximately 100 nests GE and GBH reported to Bill Thrune, USFWS; he will verify in 1988 (per. comm. 1988)
 Note: in 1984 Dean Peterson, USFWS reported a GE feeding area about 1.5 miles south east of the French Island site.

Historical Sites No Longer Occupied

Trempealeau County

In 1939 the first record of nesting (3 pairs) since the plume hunting era was recorded in this county on the Trempealeau County Migratory Waterfowl Refuge (Gabrielson 1939), near border of Trempealeau and Buffalo counties. This colony no longer exists.

1941-6 GE pairs nested (King 1949).
 1940-no nests found (King op cit.).
 1942-2 nests found (King op cit.).
 1943-at least 1 pair (Kumlien and Holliser 1903).

Vernon County

Great egrets were present along the UMR this county. King (1949) described Vernon county as an area where they were "heavy" in

abundance according to records collected from 1938-1948 but these may be references to post-breeding wanderers.

Chapin (1960) reported the presence of only one breeding site "About one mile from Genoa on an island in the Mississippi River, is a rookery of great blue herons and egrets. The rookery contains about 150 nests, of which a little over half are those of egrets." The last year of great egret activity is not known, but there were none recorded here during Thompson's (1977) aerial survey of 1977.

(The following 3 reports are from Kumlien and Hollister 1903).

Jefferson County

1863-Young taken from a tamarack swamp colony near Jefferson.

Manitowoc County

1880-Found breeding west of Two Rivers within a large colony of great blue herons.

Waukesha County

1866-Reported nesting near Waukesha.

III. RECOVERY STRATEGY

A. Plan Objectives

Due to the lack of information regarding requirements for great egret recovery possibilities in Wisconsin, no numerical goal will be set at this time. The long-range goal is to maintain a viable population of great egrets in colonies distributed throughout the state. The short-term goal will be to obtain research and habitat inventory results necessary to provide the information on which to base a minimum viable population level, and to base future management activities.

Recommendations are made regarding research and planning needs. The action plan outlines the steps needed to complete this inventory and other research and management steps intended to facilitate the recovery of this species.

B. Action Plan

1.0 Investigations

1.1 Determine recovery population level.

- 1.11 Conduct a statewide inventory of suitable nesting and feeding habitat available to great egrets.

- 1.12 Develop a model for determining a long-term minimum viable population level potential based on findings in 1.11, species' biology and any other factors determined to be influential.
- 1.2 Conduct statewide surveys.
 - 1.21 For newly discovered colonies, or for those where 5 years of population data within the last 10 years is not available, conduct the following activities annually until 5 years of data is collected:
 - 1.211 Conduct population surveys and estimate production of young annually using the most applicable techniques for each site (ie. aerial and/or ground and winter nest counts).
 - 1.212 Determine feeding sites used by breeders and post-breeding wanderers.
 - 1.213 Identify and mark nest trees in colony, collect nest tree measurements, monitor and evaluate condition of nesting trees.
 - 1.214 Map rookery species composition and monitor expansion.
 - 1.22 For colonies where 5 years of population data is available, conduct activities 1.211 through 1.214 biennially.
- 1.3 Determine if human or predator disturbance is present at rookery sites.
 - 1.31 Determine type and extent of disturbance (including researcher-induced) and assess effects.
 - 1.32 Develop effective management strategies for disturbance types found.
- 1.4 Conduct Four Mile Island Management Research Study (Appendix B).
 - 1.41 Continue monitoring population status annually, assessing techniques and improving them as necessary.
 - 1.42 Document changes in nesting and feeding habits relative to changes in species composition in the rookery.

- 1.43 Identify potential nesting and feeding habitat in Horicon Marsh and within 20 miles of the marsh.
- 1.44 Develop artificial platform nest structures to test use by great egrets and effectiveness in replacing or supplementing nesting availability.
- 1.45 Test effectiveness of lime in neutralizing the effects of guano on soil pH to allow tree regeneration.
- 1.46 Develop deer exclosure to encourage tree regeneration.
- 1.47 Conduct contaminant monitoring.
- 1.5 Determine management techniques for creating, restoring or improving habitat for great egret nesting and feeding based on findings in 1.4.

2.0 Planning

- 2.1 Develop a long-term monitoring and management program for the UMR region.
 - 2.11 Form an inter-agency (Minn., Ill., Iowa, Wis., USFWS and Corp of Engineers) working group to develop and install a long-term monitoring program.
 - 2.111 Determine monitoring needs including population dynamics, food resource use, health and longevity of nesting and feeding sites, habitat productivity, contaminant levels and effects.
 - 2.112 Determine management needs such as protection from disturbance, water level control, vegetation management, feeding site management and rough fish control.
 - 2.113 Establish methods of data gathering, determine system for analyzing and reporting results.
 - 2.114 Assign responsibilities to involved agencies, determine costs and implement program.
- 2.2 Establish a policy for protection and management of great egret rookeries on private land.
 - 2.21 Develop a list of protection options with landowners and determine feasibility.

- 2.22 Establish criteria for selecting sites and determining appropriate type of land-use agreement.

3.0 Management

- 3.1 Implement management strategies when prescribed by the UMR inter-agency working group.
- 3.2 Implement management strategies to mitigate disturbance in colonies determined to have problems.
- 3.3 Implement habitat management recommendations when available from action 1.5.

4.0 Administration

- 4.1 Develop information and educational materials (slide show and written materials) for general public use.
- 4.2 Develop informational materials for private landowners interested in managing their land to attract great egrets and other herons to nest or feed.
- 4.3 Develop criteria and policy for processing depredation or nuisance complaints that may arise.

C. Recovery Goal and Actions Justification

1.1 Recovery goal determination

Some historical information regarding great egret populations in the state prior to the plume hunting era is available, but it cannot be relied upon to illustrate the actual historical status of this species in Wisconsin because it is incomplete. The species' population recovery following the plume hunting era is better documented, particularly within the last 10 years, but this population information mainly documents recent declines (Thompson 1978). It is not logical or biologically sound to determine numerical recovery goals based only on these numbers. Instead, the goal should be based upon the availability of suitable habitat (breeding and feeding) and upon knowledge of the bird's biology, and behavior in Wisconsin.

Conduct statewide inventory of potential suitable nesting and feeding habitat for great egrets including mapping all known great blue heron colonies because great egrets nest with them. Some of these sites may have the most potential for new colonization by great egrets. Utilize wetland maps, WDNR records, known location of great blue heron colonies, information solicited from wildlife managers and other field personnel, and

other agencies. Solicit reports of roosting sites, feeding sites and flight lines from amateur bird groups. The Bureau of Research should assist with determining the recovery population level. The USFWS has produced a Habitat Suitability Index Model for the great egret but it will have to be modified for Wisconsin conditions.

1.2 Conduct statewide survey

Surveys are necessary to monitor the status of this species in the state. Since funding and personnel time are predictably limited, a thorough biennial survey and habitat evaluation system should be established so that time and money can be most efficiently used to produce the most complete and thorough results. Such a time period should be adequate to sufficiently monitor population and habitat characteristic changes except at those sites where specific studies require annual data collection.

Conduct annual population censuses at the Embarrass River colony site from 1988 to 1992. Thereafter they may be conducted biennially. The trees at this site were marked in 1980 and this should be updated in 1989. Data on colony expansion or decline should be documented annually 1989-1993 and biennially beginning 1993.

Survey the Sommerset colony from 1988-1992 and map the colony; monitor it for change in size. Thereafter, monitor the colony biennially.

1.3 Determine extent of disturbance at rookery sites.

Currently this process is most important for the UMR region because of its potential accessibility to people on foot or in boats and the relative lack of protection from human activity. The Bureau of Research should determine methods of quantifying causes and effects on colonies.

Buckley and Buckley (1976) describe various disturbance problems and effects, and techniques to control them. If a private lands policy recommends activities on private land, identifying disturbance factors and their controls (such as posting land, or requiring a 1000 ft. buffer zone around the colony, etc.) could be important management criterion.

1.4 Conduct Four Mile Island study

Potential threats to this site have been described, and management and research recommendations for Four Mile Island have previously been prepared and have been under consideration for the past several years. See Appendix B for Research Study outline.

The research and management objectives of the Four Mile Island plan are consistent with the goal of increasing great egrets in the state. Four Mile Island is an ideal research site due to the amount of historical data already accrued for the colony, the control over the site due to its isolated location and status as a State Natural Area, and because the problems facing the rookery (including decline of nesting trees, lack of regeneration and the potential lack of comparable nesting site alternatives in the area) are problems that may be crucial to resolve if the trend toward land use proceeds in the direction of reduced habitat for herons and egrets.

Buckley and Buckley (1976) stated that average colony productivity was higher in larger colonies, therefore, if the colony is reduced, production from this important site will likely be decline. The production of young from this colony is an important resource for future expansion of the great egret population in this part of the state and should be maintained.

In addition, knowledge of active management opportunities for great egrets is lacking. Artificial nesting structures have been erected for double-crested cormorants in Wisconsin and used successfully by that species and great blue herons utilized artificial nest structures erected at Phantom Lake on Crex Meadows Wildlife Area in 1975 (Evrard 1975). Results from studies on Four Mile Island will contribute valuable information regarding the potential for long-term management of great egret habitat when alternative nesting sites are limited.

1.5 Determine habitat management techniques for great egret nesting and feeding.

Management efforts specifically aimed at large, colonial waders such as great egrets have been limited. Protection through establishment of sanctuaries and legislation proved to be highly effective management strategies for resolving the problem of overharvesting by plume hunters as evidenced by the rapid recovery from near extinction.

Recent population declines have been linked to nesting and feeding habitat losses, and degradation (i.e. pollution, siltation, etc) of existing sites (Thompson and Landin 1978). But in Wisconsin, great egret management activities have largely been limited to protective measures, such as restricting entry into a colony area during the breeding season. Therefore, investigations of habitat management to be conducted at Four Mile Island should provide results upon which to base management efforts for other areas.

The effectiveness of artificial nesting platforms and techniques for neutralizing the effects of guano on tree regeneration are

not yet known. Management Research activities are listed in 4.1 and Appendix B.

2.1 Develop a long-term monitoring and management program for great egrets on the UMR.

Wisconsin should initiate the organization of an inter-agency working group of state and federal agencies to determine common goals and strategies for great egrets along the UMR. The USFWS and Corps of Engineers have established a program (Long-term Resource Monitoring Program) for comprehensive, long-term monitoring of water and sediments, vegetation, invertebrates, fish, mammals, waterbirds, land use and public use on the UMR.

Colonial waterbird monitoring is not expected to be addressed by this group before 1990 and efforts would probably be limited due to lack of personnel and funding (J. Rasmussen pers.comm. 1988). This gives Wisconsin and other UMR states an opportunity to pool resources with the USFWS to conduct the strong, viable program that is needed for great egret research and management in the UMR region. The USFWS's Environmental Management Technical Center (for the Long-term Monitoring Program) is located in LaCrosse and could be utilized as the center of coordination, communication, data analysis and storage, etc., for the states.

Properties that harbor rookeries may be "safe" in terms of ownership by state and federal governments, but hydrological alterations of the river for transportation or recreation purposes, and increased pollution of the system may cause a severe decrease in the food supply sufficient to decrease the great egret population.

It is important that on a statewide and regional basis, colonies are not concentrated into one area. The UMR is an important region for great egrets not only because of the positive aspects (numerous colonies nesting there now, apparently potential habitat for colony expansion and colonization of new sites), but also because of the potential for disaster if the river quality declines further.

Colonial waterbird monitoring techniques have been closely examined and are continually being developed and evaluated to improve data collection and reliability of population estimates. Monitoring techniques and problems are described by Buckley (et al. 1976), Erwin (1980), Erwin (et al. 1984), and the USFWS has produced a Habitat Suitability Index Model for great egrets (Chapman et al. 1984).

2.2 Establish a policy for rookeries on private lands.

A policy to address great egret feeding or nesting on private lands does not currently exist and therefore is a recommendation

of this recovery plan. The policy should be developed by the Bureau of Endangered Resources, with input from the Bureaus of Real Estate, Wildlife Management, Research, Fish Management, Legal and other appropriate WDNR bureaus, and The Nature Conservancy, because this organization is active in purchasing lands for conservation purposes and may be an important collaborator. Other interest groups and the public at large should also have an opportunity to comment.

Part of the statewide habitat suitability inventory should include information regarding ownership so that a determination of the potential for great egret nesting on private lands can be established. Currently only 1 of Wisconsin's active great egret rookeries is located on private land; the remaining rookeries are on state and federal land. As great egrets colonize new sites due to expansion or relocation, this status could change. Providing habitat on state and federal land is essential but there is no way to direct nesting onto these protected lands rather than onto private lands. There is, therefore, a need to provide long-term protection wherever the birds choose to nest. Under the Migratory Bird Treaty Act, adults, young, eggs and nests containing them cannot be molested. Nest sites are not afforded this protection and thus may be removed when the birds are absent, such as during the winter.

Listed below are some guidelines and general suggestion to consider for policy development with landowners.

A. Sympathetic Landowner

These are landowners who show concern, interest and desire for the well-being of egrets on their land.

Brushwood Island no longer contains an active great egret colony (great blue herons continue to nest here), but landowners at this site are representative of the type A owner. They expressed interest in the colony, cooperated with WDNR employees and generally are cooperative.

Suggested strategy for agreements with Sympathetic Landowner.

Verbal agreements should be formalized (not necessarily legalized) in writing. Provide a certificate of appreciation for the landowner's cooperation and a statement of agreements made between the landowner and the WDNR regarding management, monitoring, research, etc. Annual results could be given to the landowner for surveys done on her/his property.

When agreeable with the landowner, public recognition by WDNR and media information (particularly in the landowner's community) should be conducted. It may help to solidify the landowners feelings about their action, bring recognition to the cause,

educate, and encourage others to take responsibility for resource conservation.

B. Cooperative Landowner

This is the owner who is indifferent to the birds, but is willing to cooperate with the DNR if WDNR expresses interest. An example is that of the Embarrass River rookery site. The landowner is not currently planning to change the status of his property where the rookery is located, but has agreed to notify the DNR when and if he changes his mind so that the DNR will have first chance at timber rights or land purchasing. No legal action is involved until financial settlements are ready to be processed.

In cases like this WDNR should seek good terms with the landowner and request permission to carry out censuses or research on the land. Attempts should be made to educate the landowner and involve her/him in work conducted there; this could result in the landowner becoming a Sympathetic Landowner.

Suggested strategy for agreements with Cooperative Landowner.

1. Great egrets should be nesting on the land for at least five years, the rookery should contain at least 20 great egret nests with mean annual production estimated to be 2.0 young per nest, or other indication that the egret population in the colony has increased. A site should not automatically be excluded from the landowner agreement process if it does not meet the criteria described above; special circumstances should be considered.

It is nearly impossible to predict the longevity of a rookery. The factors influencing site choice and abandonment for reasons other than destruction of the site are not well understood, but 5 years of occupation allows for generational turnover and average production of 2.0 young per nest is commensurate with production rates found in other great egret colonies in Wisconsin considered to be successful.

2. The health of the nest trees should be evaluated and estimated to be adequate to sustain the rookery given typical conditions for at least 10 years after the year of purchase or easement agreement is made. Ten years of at least 20 nests with a 2.0 production rate provides 400 young for that 10 year period.

A natural disaster that causes the destruction of trees at the nest site should be treated as follows:

- a. Extent of damage should be evaluated. If some nesting trees remain, artificial nest platforms should be erected to offset tree loss (unless previous experimentation at other sites has proven that great egrets do not use nest platforms) and fast growing trees planted as a temporary

solution until more long-lived species can be established. When tree growth is sufficient to support previous colony numbers, the platforms should be taken down.

b. If all trees are downed and the site is abandoned for nesting the WDNR should have the option of restoration for future use by planting trees, or should have the option of selling the land.

3. Current or optional feeding site(s) that are adequate to sustain the colony, should be located within 15 miles of the rookery.

C. Uncooperative Landowner

This landowner is one that is planning to alter her/his property, or sell to someone else who is planning to alter the property, which would severely impact or eliminate great egret nesting, and the owner is unwilling to negotiate with the DNR.

To date, the WDNR has not taken steps to prevent logging of a rookery site when the birds are not present.

Suggested strategies for Uncooperative Landowner.

Currently all but 1 of Wisconsin's active great egret colonies are on federal or state land. This status could easily change. It may be determined that major policy changes are not critical for great egret population protection if enough potential habitat exists within state and federal lands, but the issue is one that will inevitably require further attention. Current laws may be sufficient to allow the state to purchase lands under the "power of eminent domain," but to date such power has not been exercised for the protection of Wisconsin rookeries.

Outright purchasing of land is probably not the most desirable alternative due to the finite life of a rookery. Easements, leasing land, and other less permanent alternatives may be more appropriate when dealing with less stable rookeries.

As suitable habitat declines the importance of protecting remaining habitat will escalate. Regulatory measures such as protecting nesting habitat is the next logical measure following protection of the animals themselves.

3.0 Management

Management techniques need to be developed. Experimentation with techniques to control soil chemistry, promote tree regeneration and test artificial nesting structures are recommended for Four Mile Island and should be considered a priority. No management is prescribed for any other sites. If techniques tested at Four

Mile Island prove successful, they should be employed where appropriate.

The management recommendation for the Embarrass River site is to apply the procedures for protecting rookeries on private lands when such a policy is developed.

4.1 Develop information and educational materials for public use.

Slide shows should be developed for WDNR use. Written materials such as a Life Tracks fact sheet should be produced and distributed. As a threatened species, great egrets should be emphasized, but information regarding associated species should also be produced. News releases and articles for magazines should be prepared when newsworthy information arises.

4.2 Develop informational materials for private landowners.

Information on how to manage for great egrets and other large colonial waterbirds should be made available to private landowners who wish to attract, or currently have great egrets on their property. In addition, if the private lands policy develops a program of cooperation with private landowners, informational materials, media publicity and written recognition such as a certificate should be provided.

4.3 Develop a policy for addressing nuisance problems.

Management policies for handling nuisance rookeries (rookeries in direct conflict with humans) have been developed in states such as Texas where the great egret and other large colonial waterbirds are abundant (Telfair et.al. 1986). Although Wisconsin will not experience as an abundance of birds comparable to Texas, it is conceivable that depredation problems or rookery complaints may arise with future population increases of the great egret and other herons.

Action	Plan No.	Responsibility*		Target Date	Cost				
		Lead	Cooperator		89-90	90-91	91-92	92-93	93-94
1.0 Investigations									
Determine recovery population level	1.1	ER, RS	WDNR, USFWS	1989	2,000	-	-	-	-
Conduct Four Mile Island study	1.4	ER, RS	ER, WM, UM	1991	10,000	10,000	?	?	?
Conduct statewide surveys	1.2	ER, RS	WM, VOL USFWS	ongoing begin 1989	3,000	3,000	3,000	3,000	3,000
Determine disturbance factors	1.3	ER, RS	WDNR, USFWS	1992	-	500	500	500	-
UMR Monitoring		UMR Working Group decision		ongoing begin 1990	-	3,000	3,000	3,000	3,000
2.0 Planning									
Develop UMR long-term monitoring and management program	2.1	ER, RS	WDNR, MN, IL, IA, USFWS UM, VOL	1990	3,500	-	-	-	-
Develop Private Lands Policy	2.2	ER, RS	WDNR, USFWS TNC, AU	1991	-	2,000	?	?	?
3.0 Management									
Conduct per UMR program direction		ER	WM, USFWS	ongoing begin 1991	-	-	?	?	?
Conduct statewide per 4 MI results and as needed		ER	WM	ongoing begin 1991	-	-	?	?	?
4.0 Administration									
Develop and conduct education and information	4.1	ER	IE	ongoing begin 1989	200	200	200	200	200
Conduct private land management ed. Develop nuisance/depredation policy	4.2 4.3	ER ER	IE, WM, RS	1991	-	200 200	200 -	200 -	200 -
Total Program Cost					18,000	19,100	6,900**	6,900**	6,400**

***Key to Abbreviations**

AU - Audubon
 ER - Bureau of Endangered Resources
 IA - Iowa
 IE - Bureau of Information and Education
 IL - Illinois
 MN - Minnesota
 RS - Bureau of Research
 TNC - The Nature Conservancy
 USFWS - United States Fish and Wildlife Service.
 UM - Univ. of Wisconsin
 VOL - Qualified volunteers
 WDNR - Various other bureaus in Wisconsin Department of Natural Resources.
 WM - Bureau of Wildlife Management
 Other groups may participate when appropriate or available.

**Tentative estimates, true cost pending results of management research, UMR planning team and private lands policy decisions.

APPENDIX A

Great blue heron and great egret nesting sites and population densities nesting within various segments of the floodplain of the Upper Mississippi River. *



* from Thompson 1978b.

APPENDIX B

Plan for Colonial Waterbirds in the Horicon Marsh Area (Bartelt et al. 1986).

Goal-Maintain a minimum population of 250 pairs of great egrets, 550 pairs of great blue herons, 600 pairs of black-crowned night herons and 150 pairs of cormorants at and within 20 miles of Horicon Marsh.

Strategies-Objective 1. Provide nesting habitat to accommodate goal levels for the above species.

1. Summarize nesting requirements from the literature and evaluate nest site characteristics of other Wisconsin breeding colonies.
 - a) possibly use HEP models as a frame-work for critical habitat components to be summarized for each species.
 - b) summarize values from the literature and data already collected on other Wisconsin sites to look for common characteristics among breeding colonies (tree species & size, distance to water, disturbance, canopy closure, etc.).
2. Identify potential nesting habitat at and within 20 miles of Horicon Marsh.
 - a) use information gained in Strategy 1 and aerial photos to identify possible nesting habitat.
 - b) visit potential sites to further inspect for suitability as nesting areas.
3. Document changes in nesting habitat and bird populations and determine factors affecting bird-use.
 - a) use historic aerial photos to document changes in habitat over time.
 - b) compare habitat changes to population size of birds (1971-1976, 1980-1986); multiple regression.
 - c) continue to monitor changes of habitat (tree species, size, regeneration, tree loss) to detect future years, movements, fidelity.
4. Determine factors affecting the quality of nesting habitat.
 - a) soil samples in rookery and other similar sites.

- b) enclosures to determine effects of deer browsing.
 - c) herbaceous layer as competition in rookery and on other sites.
 - d) tree regeneration at rookeries and other similar sites.
5. Develop and implement techniques to maintain or improve nesting habitat.
- a) condition soil
 - b) plant fast-growing trees
 - c) artificial structure for egrets
 - d) prevent deer browsing

Strategies-Objective 2. Provide feeding habitat to accommodate goal levels for the above species.

- 6. Summarize feeding area requirements from the literature and evaluate feeding area characteristics around other Wisconsin rookeries.
- Same methods as Strategy 1.
- 7. Identify potential feeding areas at and within 20 miles of Horicon marsh.
-Same methods as Strategy 2.
- 8. Document changes in feeding habitat and bird populations and determine factors affecting bird use.
 - a) use historic aerial photos to document changes in feeding habitat over time
 - b) compare feeding habitat changes to population size of birds.
 - c) aerial survey of study area to detect feeding area
 - d) monitor marked birds to determine current feeding area; follow birds to feeding area with aircraft/car.
 - e) sample current feeding areas for: water depth, clarity pesticides, presence of carp, emergent vegetation/open water ratio.
 - f) determine food items from under trees.

9. Determine factors affecting quality of feeding habitat.
 - a) water levels
 - b) carp populations
 - c) emergent and submergent plants; furbearer populations
 - d) pesticides
10. Develop and implement techniques to maintain or improve feeding habitat.
 - a) drawdowns
 - b) carp Control
 - c) furbearer management

Strategies-Objective 3. Develop monitoring techniques to better asses population status and nesting and feeding use.

11. Summarize literature and contact Cornell Colonial Bird Register for best census techniques.
12. Analyze variability of existing data from current census techniques.
 - a) test applicability of aerial photography
 - b) monitor individual nests for number of fledged and compare to young/nest estimate
 - c) monitor eggs for pesticide loading
13. Implement most applicable techniques to monitor population levels and nesting and feeding habitat use.
 - a) monitor annual population levels of birds
 - b) monitor nesting habitat every 5 years
 - c) check feeding distribution of birds-aerial survey
 - d) monitor feeding areas every 5 years

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Table 1. Population and production estimates of herons and egrets using Four Mile Island, Horicon Marsh, WI.*

Year ^{a/}	Great blue heron		Great egret		Black-crowned night heron		Total number of nests
	Number of nests	Young /nest	Number of nests	Young /nest	Number of nests	Young /nest	
1971	371	2.8	146	3.1	459	1.4	976
1972	538	3.1	348	2.8	169	1.5	1055
1973	669	1.8	263	2.1	381	2.3	1313
1974	768	2.2	282	2.4	516	2.2	1566
1975	639	2.2	234	2.3	356	2.3	1229
1976	872	2.5	242	2.1	500	2.4	1614
1980	534	1.9	208	2.0	1147	--	1889
1981	504 (476-532)	b/ 2.4 (2.2-2.6)	311 (285-337)	2.8 (2.5-3.1)	1246	2.7 (2.4-3.0)	2061
1982	721	2.1 (1.9-2.3)	309	2.4 (2.0-2.8)	854	1.7 (1.4-1.9)	1884
1983	474	2.3	193	2.9	367	--	1034
1984	396-503 ^{c/}	1.8 ^{d/}	139-179 ^{c/}	2.0 ^{d/}	154	--	689-836
1985	705	1.8	302	2.0	154	--	1161
1986	437	2.2	281	2.1	281	--	1021
1987	712	2.4	268	2.7	348	1.8	1380

a/ From 1971-76 data was collected by Dick Johnson on the Rock River surveys. In 1980 a complete count was attempted in June and July. In 1981-87 transects were used to estimate both the species composition of nests within the rookery and the number of young per nest in June. A complete count of all nests is conducted in January to obtain a total population estimate. January nest counts are adjusted by June species composition.

b/ Numbers in parentheses are confidence intervals.

c/ The lower number is the number counted in January. The higher number is the estimated population from June counts.

d/ Actual production was lower (10-22% for GBH; 25-26% for GE) because of a severe storm in July 1984 that caused destruction of trees, nests and young.

*From Bartelt in litt., WDNR files.